



Safety Evaluation Report for an Early Site Permit (ESP) at the North Anna ESP Site

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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**Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
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ABSTRACT

This safety evaluation report (SER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's technical review of the site safety analysis report and emergency planning information included in the early site permit (ESP) application submitted by Dominion Nuclear North Anna, LLC (Dominion or the applicant), for the North Anna ESP site. By letter dated September 25, 2003, Dominion submitted the ESP application for the North Anna ESP site in accordance with Subpart A, "Early Site Permits," of Title 10, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," of the *Code of Federal Regulations*. The North Anna ESP site is located approximately 40 miles north-northwest of Richmond, Virginia, and is adjacent to two existing nuclear power reactors operated by Virginia Electric and Power Company, which, like Dominion Nuclear North Anna, LLC, is a subsidiary of Dominion Resources, Inc. In its application, Dominion seeks an ESP that could support a future application to construct and operate one or more additional nuclear power reactors at the ESP site, with a total nuclear generating capacity of up to 8600 megawatts (thermal).

This SER presents the results of the staff's review of information submitted in conjunction with the ESP application. The staff has identified, in Appendix A to this SER, certain site-related items that will need to be addressed at the combined license or construction permit stage, should an applicant desire to construct one or more new nuclear reactors on the North Anna ESP site. The staff determined that these items do not affect the staff's regulatory findings at the ESP stage and are, for reasons specified in Section 1.7, more appropriately addressed at later stages in the licensing process. In addition, Appendix A to this SER also identifies the proposed permit conditions that the staff recommends the Commission impose, should an ESP be issued to the applicant.

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EXECUTIVE SUMMARY

Title 10, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants" of the *Code of Federal Regulations* (10 CFR Part 52) contains requirements for licensing, construction, and operation of new nuclear power plants.¹ These regulations address early site permits (ESPs), design certifications, and combined licenses (COLs). The ESP process (Subpart A, "Early Site Permits," of 10 CFR Part 52) is intended to address and resolve site-related issues. The design certification process (Subpart B, "Standard Design Certifications," of 10 CFR Part 52) provides a means for a vendor to obtain U.S. Nuclear Regulatory Commission (NRC) certification of a particular reactor design. Finally, the COL process (Subpart C, "Combined Licenses," of 10 CFR Part 52) allows an applicant to seek authorization to construct and operate a new nuclear power plant. A COL may reference an ESP, a certified design, both, or neither. It is incumbent on a COL applicant to resolve issues related to licensing that were not resolved as part of an ESP or design certification proceeding before the NRC can issue a COL.

This safety evaluation report (SER) describes the results of a review by NRC staff of an ESP application submitted by Dominion Nuclear North Anna, LLC (Dominion or the applicant), for the North Anna ESP site. The staff's review verified the applicant's compliance with the requirements of Subpart A of 10 CFR Part 52. This SER serves to identify the matters resolved in the safety review and to identify remaining items to be addressed by a future COL applicant.

The NRC regulations also contain requirements for an applicant to submit an environmental report pursuant to 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Activities." The NRC reviews the environmental report as part of the Agency's responsibilities under the National Environmental Policy Act of 1969, as amended. The NRC presents the results of that review in a final environmental impact statement, which is a report separate from this SER.

By letter dated September 25, 2003, Dominion submitted an ESP application (ADAMS Accession No. ML032731517)² for the North Anna ESP site. The North Anna ESP site is located approximately 40 miles north-northwest of Richmond, Virginia, and is adjacent to two existing nuclear power reactors operated by Virginia Electric and Power Company.

In accordance with 10 CFR Part 52, Dominion submitted information in its ESP application that includes (1) a description of the site and nearby areas that could affect or be affected by a nuclear power plant(s) located at the site, (2) a safety assessment of the site on which the

¹Applicants may also choose to seek a construction permit and operating license in accordance with 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," instead of using the 10 CFR Part 52 process.

²ADAMS (Agencywide Documents Access and Management System) is the NRC's information system that provides access to all image and text documents that the NRC has made public since November 1, 1999, as well as bibliographic records (some with abstracts and full text) that the NRC made public before November 1999. Documents available to the public may be accessed via the Internet at <http://www.nrc.gov/reading-rm/adams/web-based.html>. Documents may also be viewed by visiting the NRC's Public Document Room at One White Flint North, 11555 Rockville Pike, Rockville, Maryland. Telephone assistance for using web-based ADAMS is available at (800) 397-4209 between 8:30 a.m. and 4:15 p.m., eastern standard time, Monday through Friday, except Federal holidays. The staff is also making this SER available on the NRC's new reactor licensing public Web site at <http://www.nrc.gov/reactors/new-licensing/esp/north-anna.html>.

facility would be located, including an analysis and evaluation of the major structures, systems, and components of the facility that bear significantly on the acceptability of the site, and (3) proposed major features of emergency plans. The application describes how the site complies with the requirements of 10 CFR Part 52 and the siting criteria of 10 CFR Part 100, "Reactor Site Criteria."³

This SER presents the conclusions of the staff's review of information the applicant submitted to the NRC in support of the ESP application. The staff has reviewed the information provided by the applicant to resolve the open and confirmatory items identified in the draft safety evaluation report for the North Anna ESP, issued on December 20, 2004. In Section 1.6 of this SER, the staff provides a brief summary of the process used to resolve these items; specific details on the resolution for each open item is presented in the corresponding section of this report.

The staff has identified, in Appendix A to this SER, the proposed permit conditions that it will recommend the Commission impose, should an ESP be issued to the applicant. Appendix A also includes a list of COL action items or certain site-related items that will need to be addressed at the COL or construction permit stage, should an applicant desire to construct one or more new nuclear reactors on the North Anna ESP site. The staff determined that these items do not affect the staff's regulatory findings at the ESP stage and are, for reasons specified in Section 1.7, more appropriately addressed at these later stages in the licensing process. In addition, Appendix A lists the site characteristics and the bounding parameters identified by the staff for this site.

Inspections conducted by the NRC have verified, where appropriate, the conclusions in this SER. The scope of the inspections consisted of selected information in the ESP application and its references. This SER identifies applicable inspection reports as reference documents.

The NRC's Advisory Committee on Reactor Safeguards (ACRS) also reviewed the bases for the conclusions in this report. The ACRS independently reviewed those aspects of the application that concern safety, as well as the safety evaluation report, and provided the results of its review to the Commission in the interim report dated March 11, 2005 and in a final report dated July 18, 2005. This SER incorporates the ACRS comments and recommendations, as appropriate. Appendix E includes a copy of the report by the ACRS on the final safety evaluation, as required by 10 CFR 52.53, "Referral to the ACRS."

³ The applicant has also submitted information intended to partially address some of the general design criteria (GDC) in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Only GDC 2, "Design Bases for Protection Against Natural Phenomena," applies to an ESP application, and it does so only to the extent necessary to determine the safe-shutdown earthquake (SSE) and the seismically induced flood. The staff has explicitly addressed partial compliance with GDC 2, in accordance with 10 CFR 52.17(a)(1) and 10 CFR 50.34(a)(12), only in connection with the applicant's analysis of the SSE and the seismically induced flood. Otherwise, an ESP applicant need not demonstrate compliance with the GDC. The staff has included a statement to this effect in those sections of the SER that do not relate to the SSE or the seismically induced flood. Nonetheless, this SER describes the staff's evaluation of information submitted by the applicant to address GDC 2.

ABBREVIATIONS

ABWR	advanced boiling water reactor
ac	acre
ACR-700	Atomic Energy of Canada Advanced CANDU Reactor
ADAMS	Agencywide Documents Access and Management System
ALARA	as low as is reasonably achievable
ALI	annual limits on intake
ALWR	advanced light-water reactor
ANS	alert and notification system
ANSI	American National Standards Institute
ANSS	Advanced National Seismic System
AP1000	Westinghouse Advanced Plant 1000
ARA	Applied Research Associates
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ASTM	American Society for Testing and Materials
BRH	Bureau of Radiological Health
BWR	boiling water reactor
CDE	committed dose equivalent
CEUS	central and eastern United States
CFR	<i>Code of Federal Regulations</i>
COL	combined license
COVERERP	Commonwealth of Virginia Radiological Emergency Response Plan
CP	construction permit
CPT	cone penetrometer test
CVSZ	Central Virginia Seismic Zone
DAC	derived air concentration
DBA	design-basis accident
DCD	design control document
DEIS	draft environmental impact statement
DEM	Department of Emergency Management
DOE	Department of Energy
DSER	draft safety evaluation report
EAB	exclusion area boundary
EAC	evacuation assembly center
EAL	emergency action level
EAS	emergency alert system
ECFS	East Coast fault system
EDP	engineering department procedure
EDPI	engineering department instructions
EDS	engineering design spectrum
EIS	environmental impact statement
EMI	Emergency Management Institute
ENS	emergency notification system
EOC	emergency operations center
EOF	emergency operations facility

EPA	Environmental Protection Agency
EPDS	electronic procedure distribution system
EPIP	emergency plan implementing procedure
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ER	Environmental Report
ERDS	Emergency Response Data System
ERO	emergency response organization
ESBWR	General Electric Economic and Simple Boiling Water Reactor
ESE	east-southeast
ESIM	evacuation simulation model
ESP	early site permit
EST	earth science team
ETE	evacuation time estimate
ETSZ	Eastern Tennessee Seismic Zone
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FRERP	Federal Radiological Emergency Response Plan
FRMAC	Federal Radiological Monitoring and Assessment Center
FRP	Federal Response Plan
FS	factor of safety
FSER	final safety evaluation report
ft	foot/feet
gal	gallon
GBU	Global Business Unit
GDC	general design criterion
GIS	Geographical Information System
GSA	Geological Society of America
GT-MHR	General Atomics Gas Turbine Modular Helium Reactor
HEAR	hospital emergency and administrative radio
HEC	Hydrologic Engineering Center
HMR	hydrometeorological report
HPN	health physics network
Hz	hertz
IEM	Innovative Emergency Management, Inc.
In.	inch
INPO	Institute of Nuclear Power Operations
IRIS	International Reactor Innovative and Secure Reactor
ISFSI	independent spent fuel storage installation
ISO	International Organization for Standardization
KI	potassium iodide
kPa	kiloPascals
lb	pound
lbf/ft	pound-force per square foot
LFA	lead Federal agency
LLNL	Lawrence Livermore National Laboratory
LOCA	loss-of-coolant accident
LPZ	low-population zone
LWR	light water reactor
M&TE	measuring and test equipment

MCVH	Medical College of Virginia Hospitals
MEI	maximally exposed individual
mi/hr	miles per hour
MIDAS	meteorological information and dose assessment system
MMI	modified mercalli intensity
mrem	millirem
MSL	mean sea level
mSv	milliSievert
MT&E	measuring and test equipment
MWt	megawatt thermal
NAEP	North Anna Emergency Plan
NAPS	North Anna Power Station
NBU	Nuclear Business Unit
NCDC	National Climatic Data Center
NDCM	Nuclear Design Control Manual
NDCP	Nuclear Design Control Program
NGVD	National Geodetic Vertical Datum
NE	northeast
NEI	Nuclear Energy Institute
NEP	nuclear emergency preparedness
nmi	nautical mile
NMSZ	New Madrid Seismic Zone
NNE	north-northeast
NOAA	National Oceanic and Atmospheric Administration
NPSEPT	Nuclear Power Station Emergency Preparedness Training
NQAM	Nuclear Quality Assurance Manual
NRC	U.S. Nuclear Regulatory Commission
NRRL	nuclear-required records list
NSSL	National Severe Storms Laboratory
NUPIC	Nuclear Utility Procurement Issues Committee
NWS	National Weather Service
OBE	operating-basis earthquake
ODEC	Old Dominion Electric Cooperative
OL	operating license
OREMS	Oak Ridge Evaluation Modeling System
OSC	operational support center
OW	observation well
PAG	protective action guideline
PAR	protective action recommendation
PAZ	protective action zone
PBMR	pebble bed modular reactor
PGA	peak ground acceleration
PMCL	protective measures counterpart link
PMF	probable maximum flood
PMH	probable maximum hurricane
PMP	probable maximum precipitation
PMWP	probable maximum winter precipitation
PNNL	Pacific Northwest National Laboratories
PO	purchase order
PPE	plant parameter envelope

PPR	potential problem reporting
PQAM	project quality assurance manager
PSHA	probabilistic seismic hazard analysis
psi	pound per square inch
PWR	pressurized-water reactor
QA	quality assurance
QAPD	quality assurance program description
QAPP	quality assurance program plan
RAA	remote assembly area
RAI	request for additional information
RAP	radiological assistance program
REI	Risk Engineering, Inc.
RERP	radiological emergency response plan
RERT	Radiological Emergency Response Team
RIC	Richmond International Airport
RG	regulatory guide
RQD	rock quality designation
RS	review standard
RSCL	reactor safety counterpart link
s	second
S	south
SCC	State Corporation Commission
SCR	stable continental regions
SCS	Soil Conservation Service
SE	southeast
SEI	Structural Engineering Institute
SER	safety evaluation report
SF	scale factor
SPT	standard penetration test
SQAP	software quality assurance plan
SRCC	Southern Regional Climate Center
SSAR	site safety analysis report
SSC	system, structure, and component
SSE	safe-shutdown earthquake
SSHAC	Senior Seismic Hazard Advisory Committee
SW	southwest
SWR	service water reservoir
TEDE	total effective dose equivalent
TLD	thermoluminescent dosimeter
TSC	technical support center
UFSAR	updated final safety analysis report
UHF	ultra-high frequency
UHS	ultimate heat sink
ULF	ultra-low frequency
USACE	U.S. Army Corps of Engineers
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
VCU	Virginia Commonwealth University
VDEM	Virginia Department of Emergency Management
VDGIF	Virginia Department of Game and Inland Fisheries

VDH	Virginia Department of Health
VSP	Virginia State Police
VT	Virginia Polytechnic Institute and State University
WHTF	waste heat treatment facility
ZPA	zero period acceleration